Fisher® Z500 Severe Service Ball Valves

This bulletin covers Fisher NPS 1/2 - 36 Z500 Severe Service Ball Valves. The Z500 severe service ball valve line is a simplistic two-piece floating ball design with integral metal seat meant to provide tight metal seating shutoff in high temperature, high pressure, and erosive applications across all industries. The mate lapped ball and seat constructions help ensure sealing and the high-velocity oxyfuel coatings (HVOF) provide excellent corrosion resistance and help eliminate the problems associated with severe service conditions.

Z500 valves are available with a variety of end connections from ASME CL150 through CL4500.

All Z500 valves are designed and manufactured to be used in severe service applications. They are highly engineered to help enhance safety in potentially dangerous operating parameters and reduce valve maintenance costs.

X1200

Typical Z500 Valves

Features

- Machined Stops -- Integral 90 degree lockplate design prevents over-rotation and maintains critical alignment on lever-operated valves.
- Side Mounted Bracket -- Helps prevent stem and packing box side load and bolt stress loads by attaching to the side of the valve body.
- Live-Loaded Packing -- Packing design utilizes live-loaded spring washers for easy adjustment. Compact stuffing box and live-loaded Belleville springs ensure packing is continuously energized and protects against stem side loading and temperature fluctuations.
- Stem Adapter -- Lever-operated valves have a contact-proof stem adapter designed to prevent the stem from being knocked into the ball, causing misalignment and possible leakage.
- Blow-Out Proof Stem -- Rugged, one-piece, machined, surface-hardened and polished stem is designed to be blow-out proof. There are no pins to rely on, which helps increase safety and reliability.
- Integral Metal Seat -- Preferred sealing seat is machined into the end adapter, coated, and mate lapped with the ball. Design eliminates a potential leak path and helps the valve withstand high pressures, temperatures and severe service conditions.
- Metal Body Gasket -- Specially engineered, self-energizing gasket helps ensure that there is no leakage during thermal transients.
- High-Velocity Oxyfuel Coatings (HVOF) -- Forms a very hard and dense coating on the base metal of the ball forming a strong mechanical bond. Typically these coatings are chromium or tungsten carbide. These coatings provide exceptional wear, corrosion, and erosion resistance.

(continued on page 2)

Specifications

Valve Sizes

Z500: NPS ■ 1/2, ■ 3/4, ■ 1, ■ 1-1/2, ■ 2, ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, ■ 12, ■ 14, ■ 16, ■ 18, ■ 20, ■ 24, ■ 26, ■ 28, ■ 30 and, ■ 36

Maximum Working Pressures(1)

Forged Steel Valves: Consistent with applicable pressure-temperature ratings in table 1 per ASME B16.34, but do not exceed the material temperature capabilities shown below

Shutoff Classification(1)

Z500: Valves are tested to API 598 in the preferred flow direction.

Class V type B per FCI 70-2 in reverse flow in bi-directional design (Must be specified). For other shutoff requirements, please contact your Emerson Process Management sales office.

Construction Materials

See table 2

Temperature Capabilities(1)

Welded and Threaded Ends: SA105 - 800°F, F22 1000°F, F91 1200°F, F316 1400°F

Flanged End Connections: SA105 - 600°F, F22 800°F, F91 1000°F, F316 1000°F

Packing Constructions

Carbon Steel Valve Bodies: Wire reinforced graphite stem packing, AISI 4130 nitrided packing gland

Stainless Steel: Wire reinforced graphite stem packing, 316 SST nitrided packing gland

Dimensions

Contact your Emerson Process Management sales office

Standard Flow Direction

Preferred Flow Direction: Preferred flow for optimal sealing is forward into the integral seat

Flow Coefficients

Contact your Emerson Process Management sales office

Maximum Ball Rotation

90 degrees

Actuator Mounting

The preferred mounting orientation is vertical. Other orientations are acceptable

Approximate Weight

Contact your Emerson Process Management sales office

Options

■ Reduced port, ■ Double reduced ports, ■ Expanded outlet, ■ Scraper seats, ■ HVOF coating options, ■ Bi-directional sealing, ■ High cycle constructions, ■ Lockouts, ■ Spray and fused coatings

1. The pressure/temperature limits in this bulletin, and any applicable code or standard limitation, should not be exceeded.

Features (continued)

- Bi-Directional Sealing -- Optional bi-directional sealing is available for all configurations but must be specified when ordering. Selecting this option designates reverse flow sealing to ANSI/FCI 70-2 Class V Type B shutoff classification.
- Sour Service Capability -- Materials are available for applications involving sour liquids and gases. These constructions comply with NACE MR0103.
- Back Pressure Protection -- Welded and threaded end connection valves with 0.65, 1.15, and 1.5 inch bores come standard with a seat holder designed to protect the Belleville spring from being deformed in case of process back pressure.

Table 1. Valve Body Materials, End Connections, and Ratings

Ratings	Bore (inches)	Size, NPS	End Connection	Valve Body Materials
CL150 through 1500	0.65	1/2	Buttweld, Socketweld, FNPT, RF, RTJ	SA105, F22, F91, and F316
		3/4		
		1		
		1-1/2		
	1.15	1		
		1-1/2		
		2		
		2-1/2		
	1.5	1-1/2		
		2		
		2-1/2		
		3	Buttweld, RF, RTJ	
	2	2	Buttweld, Socketweld, FNPT, RF, RTJ	
		2-1/2		
		3	Buttweld, RF, RTJ	
		4		
	3	3	RF, RTJ	
		4		
		6		
	4	4		
		6		
	6	6		
		8		
	8	8		
		10		
	10	10		
	12	12		
	14	14		
	16	16		
	18	18		
	20	20		
	24	24		
	26	26		
	28	28		
	30	30		
	36	36		

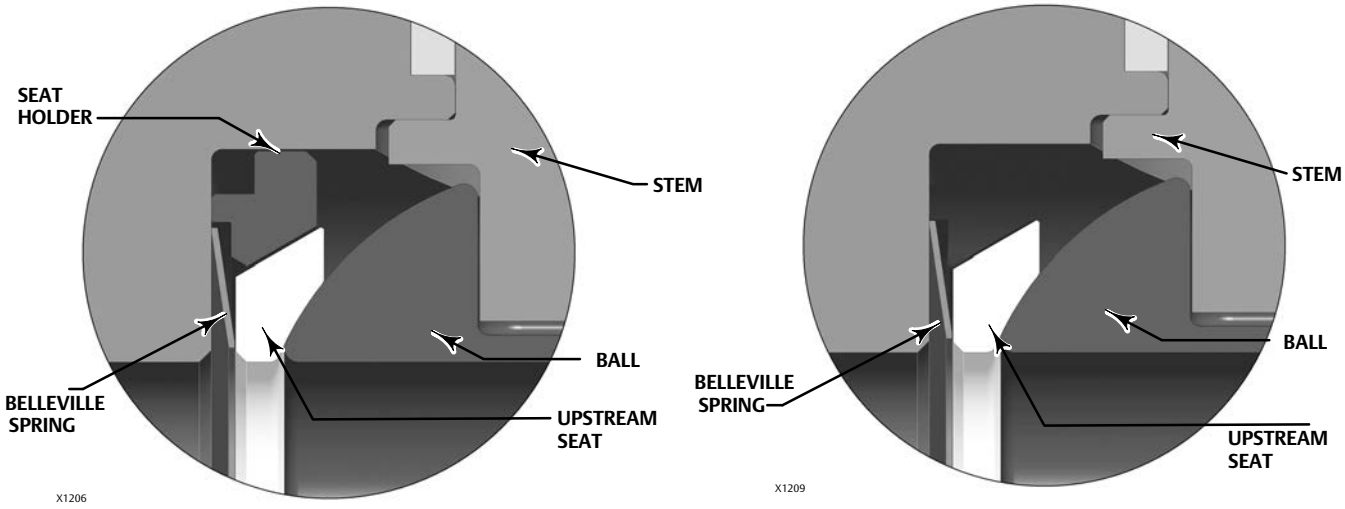
-continued-

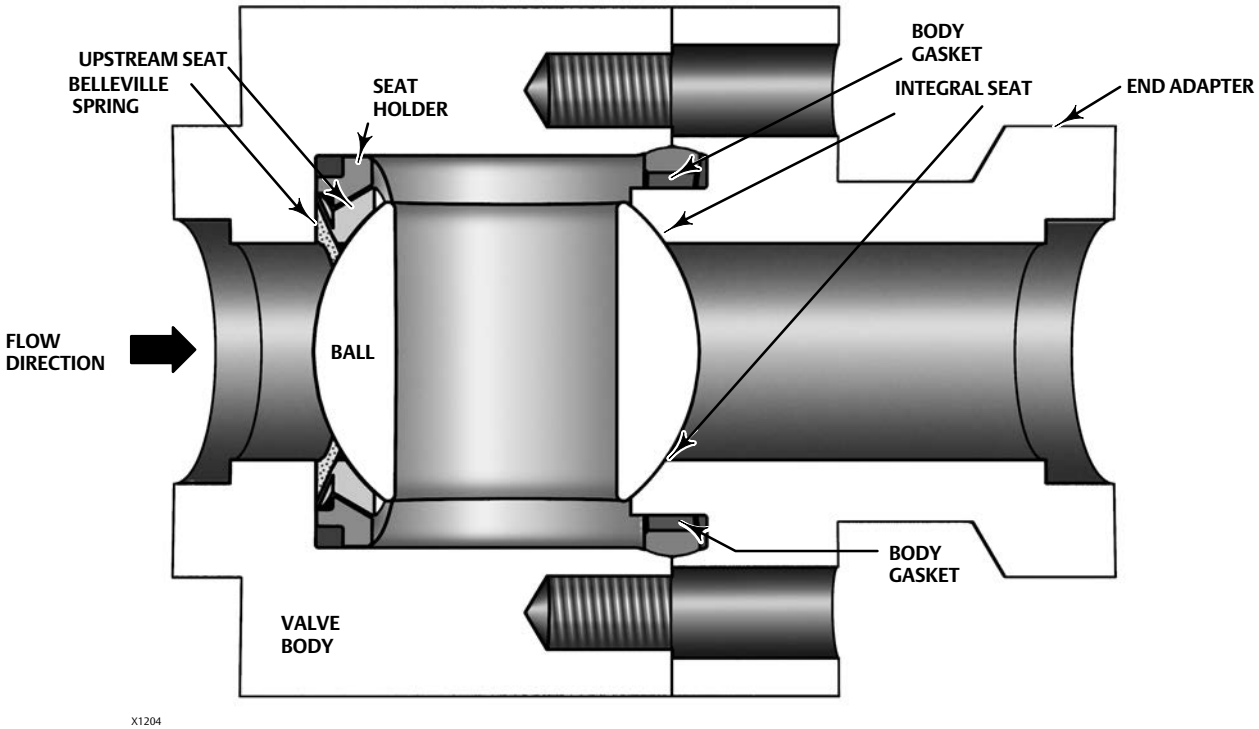
Table 1. Valve Body Materials, End Connections, and Ratings (continued)

Ratings	Bore (inches)	Size, NPS	End Connection	Valve Body Materials
CL2500	0.65	1/2	Buttweld, Socketweld, FNPT, RF, RTJ	SA105, F22, F91, and F316
		3/4		
		1		
		1-1/2		
	1.15	1		
		1-1/2		
		2		
		2-1/2		
	1.5	1-1/2		
		2		
		2-1/2		
		3	Buttweld, RF, RTJ	
	2	2	Buttweld, Socketweld, FNPT, RF, RTJ	
		2-1/2		
		3	Buttweld, RF, RTJ	
		4		
	3	3	RF, RTJ	
		4		
		6		
	4	4		
		6		
	6	6		
		8		
	8	8		
		10		
CL3200 and CL4500	0.65	1/2	Buttweld, Socketweld	F22, F91, and F316
		3/4		
		1		
		1-1/2(1)		
	1.15	1		
		1-1/2		
		2		
		2-1/2		
	1.5	1-1/2		
		2		
		2-1/2		
		3	Buttweld	

1. Not available in CL4500.

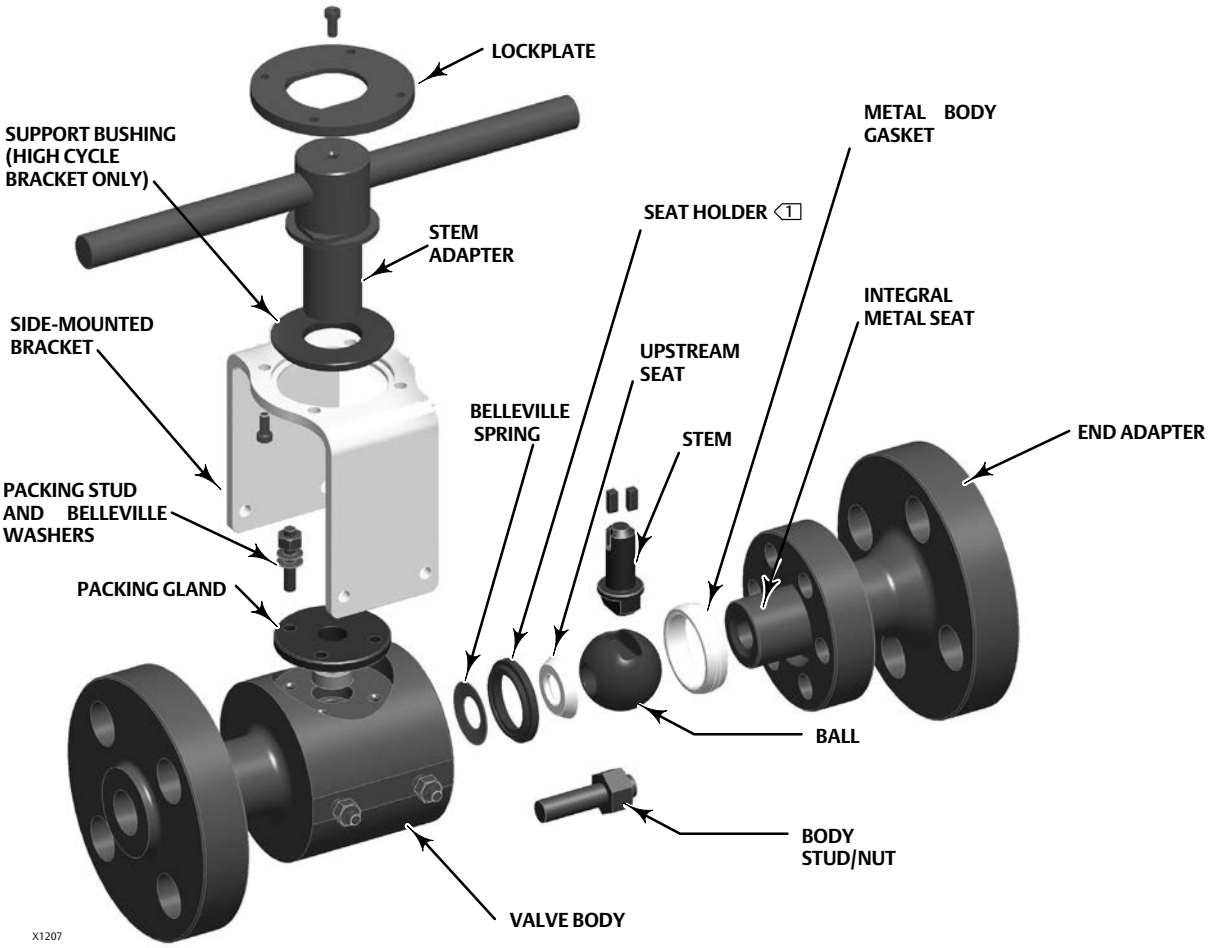
Figure 1. Z500 Construction Features





Z500 VALVE BODY CROSS SECTION

Figure 2. Z500 Construction Features

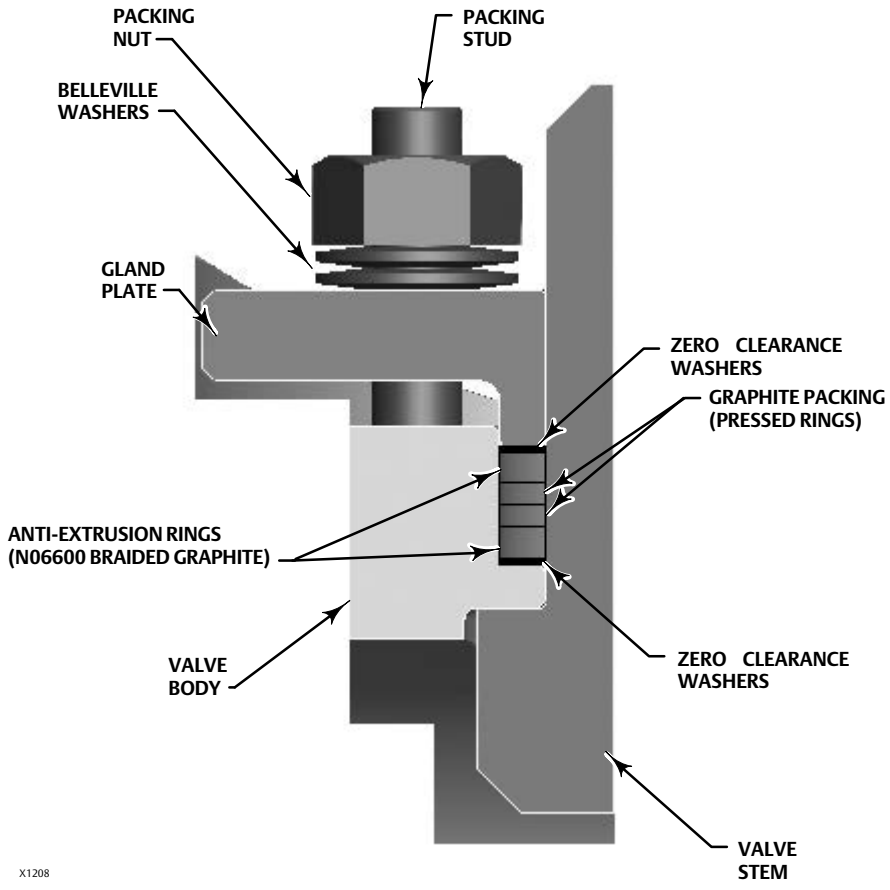


Note:
1 Seat holder is standard on welded and threaded end connections in 0.65, 1.15, and 1.5 inch bores only. Bidirectional option must be specified for all other constructions.

Table 2. Standard Construction Materials for NPS 1/2 through 36 Valves

PART	MATERIAL
Balls	F22, 316, F91, and 410
Bodies	F22, SA105, F91, and F316
Upstream seats	410/F6A, F22, 316, and F91
Body gaskets	S17400, N07718, S66286
Springs	S17400, N07718, S66286
End adapter	F22, SA105, F91, and F316
Coatings	HVOF chromium carbide
Packing	Flexible graphite with S41000 stainless anti-extrusion rings
Shafts (stem)	S17400 nitrided, N07718 nitrided, S66286 nitrided (QPQ - quench polish quench)
Key	Zinc plated carbon steel
Stem adapter	AISI 4130, 4140
Seat Holder	410/F6A, F22, F316, and F91

Figure 3. Typical Z500 Packing Arrangement



Pressure Drops

Pressure drop limits of any given valve are based on valve body and material limits. Z500 valves meet full B16.34 pressure drop capabilities up to to specified material maximum temperature limit. Information on limits for other material constructions can be obtained by contacting your Emerson Process Management sales office.

Table 3. Maximum Allowable Shutoff Pressure Drops (Body Ratings)

TEMPERATURE RANGE	PRESSURE CLASS						
	SA105 CL150	SA105 CL300	SA105 CL600	SA105 CL900	SA105 CL1500	SA105 CL2500	SA105 CL4500
°C	Bar						
-29 to 38	19.7	51.0	102.0	153.1	255.5	425.4	766.0
93	17.9	46.9	93.8	140.3	234.1	389.9	702.2
149	15.9	45.2	90.3	135.5	225.5	375.8	676.7
204	13.8	43.8	87.2	131.0	218.6	364.0	655.3
260	11.7	41.7	83.1	124.8	207.9	346.5	623.3
316	9.7	39.3	78.3	117.6	195.8	326.1	587.1
343(1)	8.6	37.9	75.8	113.8	189.3	315.4	568.1
371(1)	7.6	36.5	71.0	109.6	183.7	305.1	548.8
399(1)	6.6	34.8	70.0	104.8	174.8	291.6	524.7
427(1)	5.5	28.3	56.9	85.2	141.7	236.5	425.4
°F	Psi						
-20 to 100	285	740	1480	2220	3705	6170	11110
200	260	680	1360	2035	3395	5655	10185
300	230	655	1310	1965	3270	5450	9815
400	200	635	1265	1900	3170	5280	9505
500	170	605	1205	1810	3015	5025	9040
600	140	570	1135	1705	2840	4730	8515
650(1)	125	550	1100	1650	2745	4575	8240
700(1)	110	530	1030	1590	2665	4425	7960
750(1)	95	505	1015	1520	2535	4230	7610
800(1)	80	410	825	1235	2055	3430	6170

1. Due to material limitations, consult your Emerson Process Management sales office for flanged end connection use over 316°C (600°F).

Table 4. Maximum Allowable Shutoff Pressure Drops (Body Ratings)

TEMPERATURE RANGE	PRESSURE CLASS						
	A182 Gr F22 Class 3 CL150	A182 Gr F22 Class 3 CL300	A182 Gr F22 Class 3 CL600	A182 Gr F22 Class 3 CL900	A182 Gr F22 Class 3 CL1500	A182 Gr F22 Class 3 CL2500	A182 Gr F22 Class 3 CL4500
°C	Bar						
-29 to 38	20.0	51.7	103.4	155.1	258.6	430.9	775.7
93	17.9	51.7	103.4	155.1	258.6	430.9	775.7
149	15.9	50.3	100.3	150.7	251.0	418.5	753.3
204	13.8	48.6	97.2	145.8	243.4	405.4	729.8
260	11.7	45.9	91.7	137.6	229.3	382.0	687.1
316	9.7	41.7	83.4	125.1	208.6	347.5	625.4
343	8.6	40.7	81.0	121.7	202.7	338.2	608.5
371	7.6	39.3	78.3	117.6	195.8	326.1	587.1
399	6.6	36.5	73.4	110.0	183.4	305.4	549.5
427	5.5	35.2	70.0	105.1	175.1	291.6	524.7
454(1)	4.5	33.4	67.2	100.7	167.9	279.9	503.7
482(1)	3.4	31.0	62.1	93.1	154.8	258.2	464.7
510(1)	2.4	26.5	52.1	80.0	133.1	222.0	399.6
538(1)	1.4	18.3	36.9	55.2	92.0	153.8	276.5
°F	Psi						
-20 to 100	290	750	1500	2250	3750	6250	11250
200	260	750	1500	2250	3750	6250	11250
300	230	730	1455	2185	3640	6070	10925
400	200	705	1410	2115	3530	5880	10585
500	170	665	1330	1995	3325	5540	9965
600	140	605	1210	1815	3025	5040	9070
650	125	590	1175	1765	2940	4905	8825
700	110	570	1135	1705	2840	4730	8515
750	95	530	1065	1595	2660	4430	7970
800	80	510	1015	1525	2540	4230	7610
850(1)	65	485	975	1460	2435	4060	7305
900(1)	50	450	900	1350	2245	3745	6740
950(1)	35	385	755	1160	1930	3220	5795
1000(1)	20	265	535	800	1335	2230	4010

1. Due to material limitations, consult your Emerson Process Management sales office for flanged end connection use over 427°C (800°F).

Table 5. Maximum Allowable Shutoff Pressure Drops (Body Ratings)

TEMPERATURE RANGE	PRESSURE CLASS						
	F316 Stainless Steel CL150	F316 Stainless Steel CL300	F316 Stainless Steel CL600	F316 Stainless Steel CL900	F316 Stainless Steel CL1500	F316 Stainless Steel CL2500	F316 Stainless Steel CL4500
°C	Bar						
-29 to 38	19.0	49.6	99.3	148.9	248.2	413.7	744.6
93	16.2	42.7	85.5	128.2	213.4	355.8	640.5
149	14.8	38.6	77.2	115.8	192.7	321.3	578.5
204	13.4	35.5	70.7	106.2	177.2	295.1	531.2
260	11.7	33.1	65.8	98.9	164.8	274.4	494.0
316	9.7	31.0	62.1	93.4	155.5	259.2	466.8
343	8.6	30.3	61.0	91.4	152.4	253.7	456.8
371	7.6	30.0	60.0	90.0	149.6	249.6	456.1
399	6.6	29.3	59.0	88.3	147.2	245.5	442.0
427	5.5	29.0	58.3	87.2	145.5	242.7	436.8
454	4.5	29.0	57.6	86.5	144.1	239.9	432.0
482	3.4	28.6	57.2	85.8	143.1	238.6	429.5
510	2.4	26.5	53.4	80.0	133.1	222.0	399.6
538	1.4	25.2	50.0	75.2	125.5	208.9	375.8
566(1)	1.4	11.0	49.6	74.5	124.1	206.8	372.3
593(1)	1.4	21.0	42.1	63.1	105.1	175.5	315.4
621(1)	1.4	16.2	32.8	49.0	81.7	135.8	244.8
649(1)	1.4	12.8	25.5	38.3	63.8	106.5	191.3
677(1)	1.4	10	20.3	30.3	50.7	84.8	145.5
704(1)	1.4	7.9	16.2	24.1	40.3	66.9	120.6
732(1)	1.4	6.6	13.1	20	33.1	55.2	99.3
760(1)	1.4	5.2	10.3	15.5	26.2	43.4	77.9
°F	Psi						
-20 to 100	275	720	1440	2160	3600	6000	10800
200	235	620	1240	1860	3095	5160	9290
300	215	560	1120	1680	2795	4660	8390
400	195	515	1025	1540	2570	4280	7705
500	170	480	955	1435	2390	3980	7165
600	140	450	900	1355	2255	3760	6770
650	125	440	885	1325	2210	3680	6625
700	110	435	870	1305	2170	3620	6615
750	95	425	855	1280	2135	3560	6410
800	80	420	845	1265	2110	3520	6335
850	65	420	835	1255	2090	3480	6265
900	50	415	830	1245	2075	3460	6230
950	35	385	775	1160	1930	3220	5795
1000	20	365	725	1090	1820	3030	5450
1050(1)	20	160	720	1080	1800	3000	5400
1100(1)	20	305	610	915	1525	2545	4575
1150(1)	20	235	475	710	1185	1970	3550
1200(1)	20	185	370	555	925	1545	2775
1250(1)	20	145	295	440	735	1230	2110
1300(1)	20	115	235	350	585	970	1750
1350(1)	20	95	190	290	480	800	1440
1400(1)	20	75	150	225	380	630	1130

1. Due to material limitations, consult your Emerson Process Management sales office for flanged end connection use over 538°C (1000°F).

Table 6. Maximum Allowable Shutoff Pressure Drops (Body Ratings)

TEMPERATURE RANGE	PRESSURE CLASS						
	A182 Gr F91 CL150	A182 Gr F91 CL300	A182 Gr F91 CL600	A182 Gr F91 CL900	A182 Gr F91 CL1500	A182 Gr F91 CL2500	A182 Gr F91 CL4500
°C	Bar						
-29 to 38	20.0	51.7	103.4	155.1	258.6	430.9	775.7
93	17.9	51.7	103.4	155.1	258.6	430.9	775.7
149	15.9	50.3	100.3	150.7	251.0	418.5	753.3
204	13.8	48.6	97.2	145.8	243.4	405.4	729.8
260	11.7	45.9	91.7	137.6	229.3	382.0	687.1
316	9.7	41.7	83.4	125.1	208.6	347.5	625.4
343	8.6	40.7	81.0	121.7	133.8	338.2	608.5
371	7.6	39.3	78.3	117.6	126.9	326.1	587.1
399	6.6	36.5	73.4	110.0	114.5	305.4	549.5
427	5.5	35.2	70.0	105.1	106.2	291.6	524.7
454	4.5	33.4	67.2	100.7	98.9	279.9	503.7
482	3.4	31.0	62.1	93.1	154.8	258.2	464.7
510	2.4	26.5	53.4	80.0	133.1	222.0	399.6
538	1.4	25.2	50.0	75.2	125.5	208.9	375.8
566(1)	1.4	24.8	49.6	74.5	124.1	206.8	448.2
593(1)	1.4	20.7	41.7	62.6	104.1	173.4	312.0
621(1)	1.4	15.5	30.7	46.2	76.9	127.9	230.6
649(1)	1.4	10.0	20.0	29.6	49.6	82.7	148.9
°F	Psi						
-20 to 100	290	750	1500	2250	3750	6250	11250
200	260	750	1500	2250	3750	6250	11250
300	230	730	1455	2185	3640	6070	10925
400	200	705	1410	2115	3530	5880	10585
500	170	665	1330	1995	3325	5540	9965
600	140	605	1210	1815	3025	5040	9070
650	125	590	1175	1765	1940	4905	8825
700	110	570	1135	1705	1840	4730	8515
750	95	530	1065	1595	1660	4430	7970
800	80	510	1015	1525	1540	4230	7610
850	65	485	975	1460	1435	4060	7305
900	50	450	900	1350	2245	3745	6740
950	35	385	775	1160	1930	3220	5795
1000	20	365	725	1090	1820	3030	5450
1050(1)	20	360	720	1080	1800	3000	6500
1100(1)	20	300	605	908	1510	2515	4525
1150(1)	20	225	445	670	1115	1855	3345
1200(1)	20	145	290	430	720	1200	2160

1. Due to material limitations, consult your Emerson Process Management sales office for flanged end connection use over 538°C (1000°F).

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